

## **RESPONSE**

### **Claim Amendments**

Applicants have amended Claims 1 and 26 to provide that the oxalic-modified aluminum hydroxide material, useful as a fire retardant, has a chemical structure consisting essentially of aluminum hydroxide ( $\text{Al}(\text{OH})_3$ ) and oxalic acid moiety. This amendment is made to more particularly point out the chemical structure of the oxalic-modified aluminum hydroxide product of the claims. Support is found in Figures 2 and 3 and at paragraph [0056]. The remaining claim amendments correct for antecedent basis. No new matter is believed to have been added.

### **Rejection Under 35 U.S.C 102(b) and 103(a)**

Claims 1-9 and 26-30 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over: 1) US Patent 4,492,682 (Trebillon); 2) the English Language Abstract of JP Publication 62-235521-A; and 3) US Patent 5,480,587 (Musselman et al.).

Applicants traverse.

The Applicants claimed invention is a fire retardant material that is an oxalic-modified aluminum hydroxide. The chemical structure of the material consists essentially of aluminum hydroxide and oxalic acid moiety. As pointed out in Applicants response dated October 2, 2006, the material of the present invention is a novel, having unique physical (and chemical) properties that clearly distinguish the materials of the prior art references.

First, as Applicants have previously noted, the claimed material has a unique crystalline pattern X-ray that has a diffraction spectrum that have not been found in any other no known crystalline pattern. There are differences between the XRD pattern of the oxalic-modified aluminum hydroxide (shown in Figures 1A and 1B) and the XRD pattern of known aluminum hydroxide crystals. Applicants present a Declaration filed under 37 CFR 1.132, in which the XRD patterns for three known kinds of aluminum hydroxide crystals -- gibbsite, nordstrandite and bayerite, as shown. The Applicants believe that these XRD patterns do not match and are different from the XRD of the claimed oxalic-modified aluminum hydroxide shown in Figure 1 of the present

application. Consequently, Applicants believe that the claimed oxalic-modified aluminum hydroxide material is novel.

Second, Applicants note that the chemical structure of the oxalic-modified aluminum hydroxide material has an FTIR spectrum, shown in Fig. 3, having a strong peak at 1713.9, which corresponds to the characteristic carboxy peak at 1730, known to exist for an FTIR spectrum of oxalic acid alone. In the aforementioned Declaration, the Applicants present spectra for oxalic acid in both anhydrous and hydrated forms, for formic acid, and for aluminum hydroxide (ATH). Applicants point out that the presence of other groups on the oxalic-based compound, and of other compounds in a composition containing oxalic acid, can cause a slight shifting in the carboxyl peak. Applicants further point out that ATH does not have a carboxyl peak whatsoever, while the claimed oxalic-modified aluminum hydroxide material has a carboxyl peak. The Applicants believe that the peak at 1713 of the oxalic-modified aluminum hydroxide material is caused by the presence of oxalic acid.

Third, Applicants note that the Thermal Analysis (TA) of the oxalic-modified aluminum hydroxide material has a single peak at about 400°C, as shown in Figure 2. In contrast, an aluminum hydroxide (ATH) material that has oxalic acid in a physical mixture (not chemically structured with the ATH) with aluminum hydroxide (ATH) shows a pair of thermal peaks for oxalic acid (a first peak at about 115°C when oxalic acid changes to anhydride due to loss of bound water, and a second peak at about 202°C, when the oxalic anhydride decomposes), and one additional peak at about 302°C when the ATH decomposes. The Applicants believe that the oxalic-modified aluminum hydroxide has a chemically bonded structure consisting of aluminum hydroxide and the oxalic acid moiety. Applicants believe that such a compound is novel.

#### 1) Trebillon '682

Trebillon describes making of boehmite or pseudo-boehmite. The materials are not known to chemically contain an oxalic acid moiety. Trebillon teaches mixing a strong or weak acid, or a weak base, with amorphous aluminum hydroxycarbonate, and subjecting the solution to a first heat treatment step of not more than 90°C. Trebillon describes that the anions contributed by the acids and bases, at the reaction temperature, permit a partial exchange of the anion for the carbonate anion of the amorphous aluminum hydroxycarbonate. In the third step (a second heating step), the

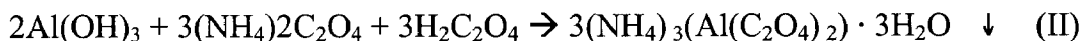
reaction solution is heated to between 90-250°C, which results in a crystallization of boehmite or pseudo-boehmite crystals out of the medium (col 3 line 65 through col 4 line 31). The boehmite crystals are then dried and calcinated. According to Trebillon, the resulting crystal products appear to have the characteristic X-ray diffraction pattern of boehmite or pseudo-boehmite, which is a material different from the oxalic-modified aluminum hydroxide of the present invention. There seems to be no accounting in Trebillon for the organic or inorganic acids or bases used as treatment agent (acetic, nitric, ammonia, ammonium acetate, hydrochloric, etc) or their anions. This suggests that the anions and their acid ligands remain in the reaction solution, and are separated from the boehmite or pseudo-boehmite crystals prior to the second heating step.

While Trebillon discloses that the acid can be selected from a group of numerous acids that does include oxalic acid, Trebillon does not disclose or suggest that any of these acids might chemically combine with ATH to form a modified aluminum hydroxide material. Trebillon also does not disclose or give any direction that points to or suggests any particular advantage or benefit of using, or the criticality of choosing, oxalic acid as the solution acid.

Consequently, Applicants believe that the claimed invention is both novel and unobvious over the reference.

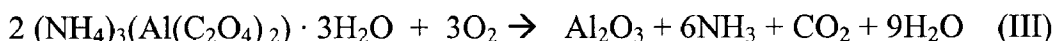
## 2) English Abstract of the JP 62-235210

The English Abstract of the JP 62-235210 teaches a reaction wherein aluminum hydroxide is mixed and reacted with ammonium oxalate to form “an oxalic acid complex of aluminum as shown” (English abstract). This “as shown” reaction appears to be the reaction equation (II) shown on page 3 of the full publication in Japanese of JP 62-235210-A, in the left column near the bottom:



The “oxalic acid complex of aluminum” thus contains nitrogen (N), and more specifically, ammonium.

Furthermore, the oxalic acid complex decomposes to ATH, ammonia, carbon dioxide and water according to Equation III shown in the left column at the bottom of page 3:



The resulting  $\text{Al}_2\text{O}_3$  of the JP Publication would be expected to have the thermal decomposition properties of ATH, and therefore thermal decomposition properties that are much

different than those thermal decomposition properties shown for the oxalic-modified material of the claimed invention.

Consequently, Applicants believe that the claimed invention is both novel and unobvious over the reference.

3) Musselman et al. '587

Musselman et al. describes an ATH in which the water of hydration is removed and a substituent material is substituted into the site vacated by the water of hydration. The reference teaches that the method suppresses the vapor pressure of the substituent, stabilizing it to a temperature greater than 100°C above its evaporation temperature (col 6 lines 1-9). Musselman et al. exemplify a glycol-treated ATH that is made by first driving off the water of hydration in aluminum trihydrate, then adding the boiling glycol, filtering and drying. The glycol replaces the water of hydration to modify the exothermal properties of the product. The description and Figures referred to by the Examiner in the Action appear to all relate to the glycol treated material. Musselman et al. state that substitutions for the water of hydration include a larger number of inorganic salts, organics, and organic acids, one of which is oxalic. However, Musselman et al. do not disclose or suggest reacting the substituent with the aluminum hydroxide to chemically modify the structure of ATH as provided by the Applicants' claimed invention. Musselman et al. also do not disclose or give any direction that points to or suggests any particular advantage or benefit of using, or the criticality of choosing, oxalic acid as the substituent material. Furthermore, the resulting substituted  $\text{Al}_2\text{O}_3$  material of Musselman et al. would have thermal decomposition properties that are much different from those thermal decomposition properties shown for the oxalic-modified material of the claimed invention.

Consequently, Applicants believe that the claimed invention is both novel and unobvious over the reference.

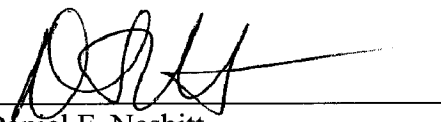
This is believed to represent a complete response to the Office Action. Reconsideration and withdrawal of the rejections, and an early allowance, are respectfully requested.

Applicants would like to reserve the opportunity to have the withdrawn method claims rejoined so that appropriate method claims amendments can be made to include the limitations made to the material claims.

It is believed that the amendments and response represent a complete response to the rejection and place the application into condition for allowance.

Respectfully submitted,

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Attached: Applicants' Declaration under 37 CFR 1.132 with Exhibits